Contribution to the Discussion about the Classification and Cartography of Salt Affected Soils

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There are some difficulties in the systematization of saline and alkaline soils due to the high variation of kind and sources of salinization. At the same time the effect of these soil types on plant growth varies significantly.

While the kind and intensity of salinization is rather easy to determine through laboratory methods, there exist very great differences in the sources and dynamics of saline soils. Consequently the morphology varies very notably and it is connected directly with the genetics of these soils.

Therefore, following the traditional European particularly the Eastern European philosophy of research, it is necessary to introduce the genetics of salt affected soils into the classification. In the proposal of the "Sub-Commission on salt affected soils", which has the inventory and cartography of these soils as its primary target, genetics are expressed in the differentiation of the group of alkaline soils into:

a) sub-class without structural B horizon,

b) sub-class with structural B horizon.

The world map of salt affected soils, for which the first basic figures were presented at the 9th International Congress of Soil Science in Australia (1968), should be prepared on a scale of 1 : 2.5 millions and presented at 1 : 5 millions. It is obvious that on such a scale a detailed differentiation will not be possible, and consequently it is required to indicate in this map only:

1. Saline soils.
2. Alkaline soils: *a)* with structural B horizon,
   b) without structural B horizon.
3. Potential saline and alkaline soils.

In many countries, where salt affected soils exist and research work is being conducted, a considerable amount of detailed information is available. This information could be used for more detailed differentiation in soil maps of higher scale. The question is how can we carry out a more detailed classification of salt affected soils, useful for soil maps?

It is not too early to hold conversations on an international level to establish guide lines for individual scientists working on this subject all over the world, in order to correlate their valuable studies. This should allow an easier understanding of the detailed situations in the different countries.

On the other hand, the main classification, already established, should permit the presentation of details (Sub-classes, etc.) without problems and contradictions. So I propose that the maps be prepared as follow:

World map	Map of single countries	Provincial maps
1 : 5.000.000	1 : 100.000/1 : 50.000	1 : 20.000/1.10.000

Agricultural working maps
1 : 10.000/1 : 2.000

Although there is no doubt about the importance of the world map of salt affected soils and even the maps of single countries, there is a very deep interest in large scale maps especially as "working sources" for projects, land planning and agricultural work. Consequently, there is very intensive and detailed activity around the world and the coordination of this work would be one of the most honorable obligations of the International Society of Soil Science (Sub-Commission on Salt Affected Soils). This coordination is pressing, since we are working at the world map, inasmuch as the detailed large scale work has to be incorporated into the small scale map.

This requirement sounds very simple and logical, but its realization actually seems to be very difficult. Although there is much international interchange of ideas there exist many different patterns in the systematization of salt affected soils.

As mentioned above, it does not seem acceptable to ignore genetics and morphology in establishing a classification for salt affected soils. Therefore, it is important to indicate that in saline areas there frequently appear soils whose horizons are built up not, or not only, as a consequence of soil processes, but whose differentiation was caused by the sedimentation of geological materials (strata) of different texture and age (see Husz [2]).

These soils do not have "real horizons" according to the classical definition but "pseudo horizons". On the other hand, it would not be correct to talk about geological layers (strata) only. These differentiated materials being located in the active soil profile have a direct influence on soil processes which in turn influence the strata. According to this interaction, between the strata and the soil processes, a morphological phenomenon results which is typical for each soil profile.

For instance, an alkaline soil with a structural B horizon, because of its dynamics, could be called a classical "Solonetz", but a profile whose B horizon was not built up by these dynamics (illuviation), but by the sedimentation of a clay material secondarily covered by a fine sandy sediment, should be called "pseudo-solonetz" or "strato-solonetz".

These pseudo horizons appear more frequently than realized. It would be very regrettable if, in this very important mapping work carried on by the Sub-Commission of the International Society of Soil Science, these observations were not taken into account. Also, secondary saline soils have world-wide distribution. They are soils which first developed to a certain non-saline soil type. Due to a change in the oecosystem, they became salinized. To clearly show this history such soils could be called by their original type name and the prefix "saline" added. For instance "Saline-Chernosem" (see Husz [1]).

Table 1

Scheme for the classification of salt affected soils

Saline soils		Na % TEC < 15%	Typical S.	Typical	Cl — S.	Low, medium, extreme	
				Typical	SO_4 — S.	Low, medium, extreme	
		Solonchak	Pseudo S.	Pseudo	Cl — S.	Low, medium, extreme	
				Pseudo	SO_4 — S.	Low, medium, extreme	
		EC > 4000 μS.cm^{-1}	Secondary S.	Secondary	Cl — S.	Low, medium, extreme	
				Secondary	SO_4 — S.	Low, medium, extreme	
Alkaline soils	Without structural B horizon	Na % TEC ≧ 15%	Typical Solonchak-Solonetz	Low	Cl — S.S.	Cl 50% of T.S.	Na % TEC 15—20
				Medium	Cl — S.S.		20—25
				Extreme	Cl — S.S.		>25
				Low	SO_4 — S.S.	SO_4 50% of T.S.	15—20
				Medium	SO_4 — S.S.		20—25
				Extreme	SO_4 — S.S.		>25
				Low	CO_3 — S.S.	$CO_3 + HCO_3$ 50% of T.S.	15—20
				Medium	CO_3 — S.S.		20—25
				Extreme	CO_3 — S.S.		>25
		Solonchak-Solonetz	Pseudo Solonchak-Solonetz	Low	Ps. Cl — S.S.	Cl 50% of T.S.	15—20
				Medium	Ps. Cl — S.S.		20—25
				Extreme	Ps. Cl — S.S.		>25
				Low	Ps. SO_4 — S.S.	SO_4 50% of T.S.	15—20
				Medium	Ps. SO_4 — S.S.		20—25
				Extreme	Ps. SO_4 — S.S.		>25
				Low	Ps. CO_3 — S.S.	$CO_3 + HCO_3$ 50% of T.S.	15—20
				Medium	Ps. CO_3 — S.S.		10—25
				Extreme	Ps. CO_3 — S.S.		>25
				Low	Sec. Cl — S.S.	Cl 50% of T.S.	15—20
				Medium	Sec. Cl — S.S.		20—25
				Extreme	Sec. Cl — S.S.		>25

Alkaline soils	Without struct. B horizon	EC > 4000 μS.cm^{-1}	Secondary Solonchak-Solonetz	Low Sec. SO_4 — S.S. Medium Sec. SO_4 — S.S. Extrem. Sec. SO_4 — S.S.	SO_4 50% of T.S.	15—20 20—25 >25
				Low Sec. CO_3 — S.S. Medium Sec. CO_3 — S.S. Extreme Sec. CO_3 — S.S.	$CO_3 + HCO_3$ 50% of T.S.	15—20 20—25 >25
	With struct. B horizon	Na % TEC > 15%	Typical	Low Medium Extreme		15—20 20—25 >25
		Solonetz	Pseudo	Low Medium Extreme		15—20 20—25 >25
		EC ≤ 4000 μS.cm^{-1}	Secondary	Low Medium Extreme		15—20 20—25 >25
Potential saline and alkaline soils		• / •	• / •	• / •	• / •	
Saline soils		Solonchak	Typical / Pseudo — / Secondary		Low, medium or extreme Cl or SO_4 — S.	
Alkaline soils	Without struct. B horizon	Solonchak solonetz	Typical / Pseudo — / Secondary		Low, medium or extreme Cl, SO_4, $CO_3 + HCO_3$ — S.S. according to ESP.	
	With Struct. B horizon	Solonetz	Typical / Pseudo — / Secondary		Low, medium or extreme according to ESP.	
Potential saline and alkaline soils			• / •		• / •	

How a concept of systematization, taking into account chemical and physiological limitations and figures, and also the genetics and morphology of the soil, could be established is shown in the enclosed scheme (Table 1).

In this pattern, referring to "Solonchak-solonetz", this soil is divided into "low", "medium" and "extreme" based only on the range of exchangeable sodium content. This may be justified by the observation that the sodium exchange capacity has the main influence on the properties of such soils. There is, of course, no obstacle to differentiation also on the basis of the range of salinity.

References

[1] Husz, G.: Zur Systematik der Salzböden des Seewinkelgebietes in Österreich. Die Bodenkultur. **17.** 295—310. 1966.

[2] Husz, G.: Zur Kenntnis der jungquartären Sedimente des Seewinkels im Burgenland. Eisenstadt. Wiss. Arbeiten aus dem Burgenland. Heft. 32. 1965.